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METHOD AND DEVICE FOR ATTACHING GLASS SUBSTRATES FOR LIQUID CRYSTAL DISPLAY PLATE

[Abstract]

PURPOSE: To provide the method and device for sticking which perform high-precision sticking and fixation with good efficiency.

CONSTITUTION: One substrate where electrodes having a specific pattern and positioning marks are patterned and spacers are scattered on its surface and the other substrate where electrodes and positioning marks are patterned and a seal material 35 made of ultraviolet-ray setting resin is applied along its peripheral edge are put one over the other so that the seal material 35 is positioned between the

substrates (a) and (b); and the positioning marks of both the substrates (a) and (b) are aligned with each other while the substrates are pressed, and after the marks are completely aligned, the coating part of the seal material 35 is irradiated with ultraviolet rays to stuck both the substrates (a) and (b) in one body. The device A which carries out the method is provided with a fixed base plate 2 below a machine frame 1 and fitted with a movable base plate 3 above the fixed base plate 2 in a free upward/downward movable state; and a lower surface plate 4 is fitted on the fixed base plate 2 horizontally movably and an upper surface plate 5 is fitted below the movable base plate 3, and an ultraviolet-ray irradiation part 19 which emits ultraviolet rays upward is provided in the lower surface plate 4.

[Claims]

【Claim 1】 A method for attaching glass substrates which are used for liquid crystal displays comprising the steps of:

patterning one substrate with an electrode having a specific pattern and positioning marks and having spacers scattered on its surface;

patterning the other substrate having electrodes and positioning marks;

applying a seal material made of ultraviolet-ray hardening resin along its peripheral edge over the other so that the seal material is positioned between the substrates (a) and (b);

aligning the positioning marks of both of the substrates (a) and (b) while the substrates are pressed until the substrates are completely aligned with each other; and

irradiating the coating part of the seal material with ultraviolet rays to attach both of the substrates (a) and (b) in one body.

【Claims 2】 A device for attaching glass substrates which are used for liquid crystal displays comprising:

a fixed base plate provided below a machine frame;

a movable base plate is provided above the fixed base plate in a free upward/downward movable state;

a lower surface plate fitted on the fixed base plate horizontally movably;

an upper surface plate fitted below the movable base plate; and

an ultraviolet-ray irradiation part emitting ultraviolet rays upward is provided in the lower surface plate.

[Title of the invention]

METHOD AND DEVICE FOR ATTACHING GLASS SUBSTRATES FOR LIQUID CRYSTAL DISPLAY PLATE

【Detailed Description of the Invention】

【Field of the Invention】 The present invention relates to a method and a device for attaching glass substrates (upper and lower electrodes) used for liquid crystal displays.

[Background of the Invention]

Liquid Crystal Displays are characterized in that the liquid crystals can be sealed inside the seal material by using spacers of a number of μm between two glass substrates coated with transparent conductive electrodes, thereby attaching the two glass substrates in one body using positioning marks. However, the conventional methods of attaching two glass substrates by previously formed positioning marks on the glass substrates are driven by the detection data of mark detection means that is used in telescopes and cameras and control a lower surface plate that moves in the x, y, and θ directions, thereby controlling to provide an approximate alignment and a precision alignment. At the point of alignment of the marks together, the two glass substrates are pressed.

[Object of the Invention]

The above-mentioned conventional attaching methods, after alignment of the marks is completed, it is temporarily attached. However, at the time of pressing, the aligned glass substrates could move apart from each other. Due to this problem,

the extent of displacement from each other at the time of pressing was re-checked in order to find out whether the amount of displacement was within an acceptable range, and thereafter, it was properly handled according to the results, which was a problem. In addition, after the alignment of the marks is completed, in order to provide an attaching fixing means to completely fix the upper and lower plates were maintained in the same condition, the upper and lower plates were aligned with each other. However, the alignment was positioned on the outer side of the seal material, thereby permits the attaching of ultraviolet-ray hardening resin, and in order to attach such, a spreading process is needed. In order to do so, the spreading step is required, and after the temporary attachment, the upper and lower substrates must be moved in order to completely attach. As a result, the problem of displacement from the alignment can be arisen at the step of moving the substrates.

Moreover, the attaching device that uses the above method provides the functions of alignment of the upper and lower substrates and a temporary alignment. However, it does not provide an attaching means of a complete fixation, thus requiring another independent device for attaching. Thus, the problem of the formation of a series of attaching line is found.

The problems of the conventional methods were considered in achieving the present invention. The object of the present invention is to provide the method and device for attaching which perform high-precision attaching and fixation with good efficiency.

[Means to Solve the Problems]

In order to achieve the above-mentioned object, the present invention provides previously designed patterned electrodes and the positioning marks that are patterned while having one substrate having a spacer scattered on the surface of one side and another side patterned electrodes and positioning marks and having one side of the substrate spread sealing material to ultraviolet-ray hardening resin along its peripheral edge of the substrates. Then, both the substrates are folded such that the sealing material is positioned between the substrates before the positioning marks of both of the substrates are pressed to align with each other. When the alignment is completed, ultraviolet rays are irradiated to where the sealing material is spread to attach the substrates to become one body.

According to the attaching device, a fixed base plate is positioned below the body of the device and a movable base plate is positioned above the fixed base plate in a free upward/downward movable state. Additionally, while a lower surface plate is disposed above the fixed base plate, an upper surface plate is disposed below the movable base plate such that each of the plates can move horizontally; the attaching device provides a ultraviolet-ray irradiation part inside the lower surface plate, wherein ultraviolet rays are disposed such that it irradiates upward.

The upward/downward movement of the movable base plate can either execute the means of moving up and down a certain distance and then pressing the two plates separately or execute the means of moving upwardly/downwardly and pressing at one step.

With respect to the lower surface plate and the upper surface plate moving in a horizontal direction, the lower surface plate can move in one of X, Y or θ directions.

Moreover, the upper surface plate can be set up to move in a direction, X or Y, in which the lower surface plate does not move, or the lower surface plate can be set up to move in X or Y direction.

[Effect of the Invention] According to the above-mentioned means, one side of a plate where the sealing material is applied is formed of ultraviolet-ray hardening resin. By aligning the marks to face together while the upper and lower substrates, a definite gap between the upper and lower substrates are made and the sealing material applied to the gap between the upper and the lower plates is hardened by irradiating ultraviolet rays to the sealing material, thereby achieving the fixation of the attachment of the upper and the lower substrates.

[Effects of the Invention] As explained above, the attaching method of the present invention comprises forming sealing material into an ultraviolet-ray hardening resin, facing of the marks together while the upper and lower plates are pressed, and irradiating ultraviolet rays to the sealing material when the marks are aligned with each other, thereby getting an efficient attaching of the plates with a high precision can be achieved.

Moreover, the attaching device that executes the above-mentioned attachment provides an ultraviolet-ray irradiating means that irradiates ultraviolet rays on the upper portion of the lower surface plate, and the marks are being positioned to align each other while the plates are being pressed. After the marks are completely aligned, ultraviolet rays can be irradiated to the upper and lower substrates that are positioned between the upper surface plate and the lower surface plate, thereby

shortening of the attaching process can be achieved by not needing an extra means of a separate alignment.

[Example] The working example of the present invention is explained as below based on the figure. The attaching device A provides a machine frame 1, a fixed base plate 2 below the machine frame 1, a movable base plate 3 that is positioned above the fixed base plate 2, a lower surface plate 4 which carries a glass substrates, and thereby providing a support, is positioned below the fixed base plate 2, and an upper surface plate 5 positioned below the movable base plate 3 contains the glass substrates b which is maintained by absorption.

The movable base plate 3, which is disposed above the fixed base plate 2, is disposed in guide rail 7, which is adhered to four standing pillars 6, such that the movable base plate 3 is set up within a sliding enlargement device 8, which freely slides upward and downward while engaged with the guard rail 7. On the surface of the movable base plate 3, while two hanging rods 9, which are in a substantially rectangular shape, are on the upper part of the hanging rod 9 is connected by a connecting plate 10.

On the hanging rod 9 which crosses between the standing pillars 6, a spring 12 is pressed to be attached between a connecting plate 10 and the horizontal rod 11. The movable base plate is supported such that it does not fall beyond the lowest end point. Moreover, the driving source of the movable base plate 3 that is forcefully pressed is an air cylinder 13, and the air cylinder 13 is fixed below the

horizontal rod 11, such that a flexible rod 13' having a vertical hem can press the movable base plate 3.

The lower surface plate 4, which is positioned above the fixed base plate 2, is consisted of a lower element 14, which slides in Y direction on the fixed base plate 2, an upper element 15, which moves back and forth horizontally. The lower element 14 is positioned to stand on the fixed base plate 2 and is supported by the engagement device 17, which is engaged with the two guide rails 16 that are parallel to each other such that sliding is possible. In addition, with respect to the lower element 14, the upper element 15, which is supported by the lower element 14, and a bear ring 18 is positioned between the upper element 15 and the lower element 14 such that the upper element 15 can be rotated.

Furthermore, the upper element 15 of the above-mentioned device is provided with an ultraviolet-ray irradiating part 19. The ultraviolet-ray irradiating part 19 is disposed in the center of the upper element 15 that is made up of metal material; a concave portion 20 which has a width that could cover the size of glass substrates a and b, which is processed by attaching, is formed, and the concave portion 20 has the same shape as the previously mentioned concave portion 20. In addition, while a quartz plate 21 having one side corresponding to the surface of the upper element 15 is inserted therebetween to be fixed, the other side of the quartz plate 21, in other words, providing a reflex layer 22 between the concave portion 20 and the quartz plate 21, and then, providing a guiding pathway 23 such that ultraviolet rays are guided by the pathway 23 to be irradiated towards the exterior of the upper element 15, thereby the rays are introduced through the guiding pathway 23 using a material

such as an optical fiber.

Moreover, ultraviolet rays are transmitted to the surface of the quartz plate 21 by the upper element 15; a shock-absorbing element 24, which has a function of maintaining the glass substrate a that is engaged by an adhesion friction as one body, thus protecting the glass substrate a and the surface of quartz plate 21.

The moving mechanism of the lower element 14, which slides in the Y direction with respect to the fixed base plate 2, is moved in the Y direction by the cam mechanism, such as the moving mechanism of the upper surface plat 5 as mentioned later, which moves in X direction. Moreover, the moving mechanism that moves it in the θ direction rotates using the mechanism of a rotating cam 25 disposed on the side of the lower element 14; a receiving roller that is supported by the protruding arm that is protruding from the upper element 15; and of springs which carry out pressing energy of a roller and its receiving roller in the direction supported to the rotating cam 25 which is attached in the lower element 14, by actuation of the pulse motor 26.

Suspension support of the upper surface plate 5, which is supported by the inferior surface of tongue of the movable base plate 3, is carried out through the engagement object 28, which engages with two parallel guide rails 27 fixed to the inferior surface of tongue of the movable base plate 3, and slides. The upper surface plate 5 is moved in the X direction b the cam mechanism. In other words, it consists of the rollers 31 and the springs 32 which carry out press energization of the upper surface plate 5 to a rotating cam 29 side attached through the rotating cam 29 which it is supported at the movable base plate 3 side, and is rotated, and the

connecting element 30 made to attach to shock plate 5' by the side of the upper surface plate 5, and drive rotation of the rotating cam 29 is carried out by the pulse motor 33, which is built in the reducer.

Moreover, an open-hole 41 on which a vacuum suction force acts is formed in the field where glass substrates b in the upper surface plate 5 mentioned above contacts, and the open-hole 34 is connected to the vacuum pump.

The lower glass substrate a is fixed to the shock-absorbing element 24 disposed on the upper element 15 of a lower surface plate 4 by the adhering friction force. On the upper side of the quartz surface plate 21, the absorption maintenance of the upper glass substrate b is carried out by the vacuum suction force in the inferior surface of the tongue of the upper surface plate 5, the movable base plate 3 is depressed by actuation of an air cylinder 13, and, as for the upper surface plate 5, the polymerization of the glass substrates a and b is carried out by the above configuration. Moreover, the alignment of the positioning marks on the glass substrates a and b is executed by a mark detection means provided in the attaching device. The extent of the displacement of the positioning marks on glass substrates a and b is controlled to move the amount of displacement in the direction of X, Y or θ.

At this time, the lower surface plate 4 is movable in the direction of Y and θ, and since the upper surface plate 5 is movable in the direction of X, it can perform rough alignment and precise alignment while pressurizing the upper and lower glass substrates. Moreover, since migration adjustment of the lower surface plate 4 and the upper surface plate 5 produces the amount of displacement of the direction of a

straight line in rotation of the rotating cam which consists of an eccentric cam and performs migration of the direction of X, Y and θ by it, its extent of movement (variation amount) is small, highly precise and very small delivery can be made. In addition, in terms of the movement adjustment in the directions of X and Y, when the variation amount according to the rotation of a rotating cam is being delivered to the lower element of the lower surface plate by the connecting element having a receiving roller or to the upper surface plate, a part of the connecting element which is mechanically attached on a pressure-supporting plate can be converted to a form as shown before the piezoelectric actuator can be shown.

If the ultraviolet-ray irradiation part 19 prepared in the upper element 15 of the lower surface plate 4 with the condition of having pressurized is operated and ultraviolet rays are irradiated up through the quartz surface plate 21 when alignment is completed carrying out and pressurizing glass substrates a and b like the above ultraviolet rays are irradiated by the sealing material 35 which consists of ultraviolet hardening resin crushed between glass substrate a and b, and by it, a sealing material 35 is hardened by being pressurized and carries out the fixing the glass substrates a and b completely aligned. Moreover, since the lower glass substrate a appears on shock-absorbing element 24, it can prevent uneven push crushing of the sealing material 35 produced by the unevenness of the thickness of glass substrates a and b or the unevenness of the front side of the lower surface plate.

[Description of the Drawings]

[Figure 1]

【Description of the Drawings】

【Figure 1】 A part of sectional front view of an example of the present invention

【Figure 2】 A sectional enlarged view of the main parts of the invention

【Figure 3】 A cross-sectional view of Figure 2 (3)

【Description of Symbols】 A: attaching device; 1: machine frame; 2: a fixed base plate; 3: a movable base plate; 4: a lower surface plate; 5: an upper surface plate; 19: ultraviolet-ray irradiating part